Using This Flip Chart

When a solar flare or CME erupts from the Sun, a radio signal is emitted that reaches Earth in a little over 8 minutes! By following the steps in this flip chart you will soon be able to answer the big question, **“Have signals been recorded today due to a flare or CME that could affect Earth?”**

In the flipchart you will find **INSTRUCTION CARDS** followed by **INF0RMATION CARDS**.

- **INSTRUCTION CARDS** contain every step necessary to obtain, analyze and record all required online data.
- **INFORMATION CARDS** contain a variety of sample images and helpful tips when interpreting and analyzing the data.

Don’t forget to keep your **Data Collection Sheets** nearby in order to collect all of the information you will need to complete your Space Weather News Report!

Live Data and Tutorials
http://son.nasa.gov/tass/tools.htm

University of Florida

1. Open http://son.nasa.gov/tass/tools.htm and click on " **University of Florida "** (live data). The "Internet Jupiter Radio Observatory" website will open.
2. Click on the word [**Run**] in the third line. You will see a graph with several multi-colored lines showing data from several different antennas.
3. Adjust the graph so that it only shows data coming from the ground-based radio receivers in Florida. This can be done by using the 'drop down' lists in the upper left hand side of the webpage:
   - From the "**Time Span**" list, select '**RJ 15**'
   - From the '**Refresh Rate**' list, select '**30**' seconds. (You can select faster or slower refresh rates if desired.)
   - Click '**Run**'
4. You should now see a single red graph. This is the Radio JOVE receiver in Florida. (If you see a *straight red line*, the data is currently unavailable . Simply move on to the next section, "GOES 5-min X-ray Plot".)
5. Refer to your 'Storm Signals Data Collection' sheet to answer questions **(a)** through **(d).**
6. Close the current window and return to http://son.nasa.gov/tass/tools.htm .

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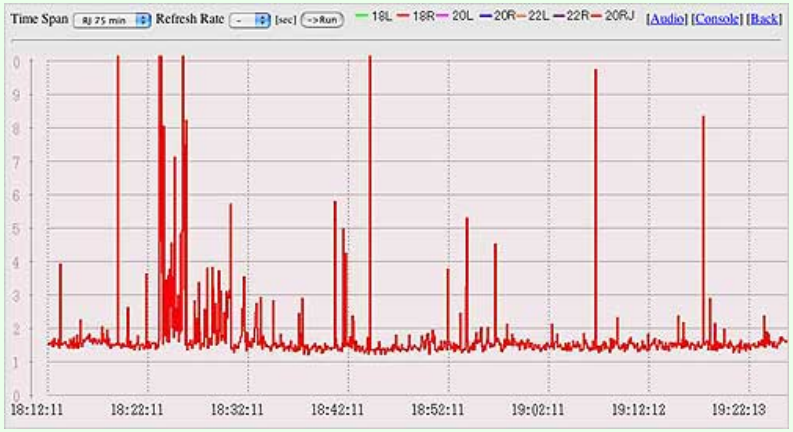
ANALYSIS TIPS:



Sharp spikes in the graph are usually due to man-made signals or lightning strikes.

The graph of a solar storm would show a gradual rise and fall in the signal over several seconds to several minutes and would look somewhat like a shark's fin.

ABOUT THE DATA:

When a solar flare or coronal mass ejection erupts, hot, charged particles are accelerated away from the Sun. When this happens, a radio signal is emitted that reaches Earth in a little over 8 minutes providing the first signal that a solar storm is headed our way. However, the particles from that same storm usually take up to 3 days to reach Earth.

Solar flares and Coronal Mass Ejections (CMEs) emit a broad range of light. Most of this light is invisible to us. To detect solar storms we will use radio waves, x--rays, and ultraviolet light. Radio waves are especially useful because they can be measured by instruments on the Earth and in interplanetary space.

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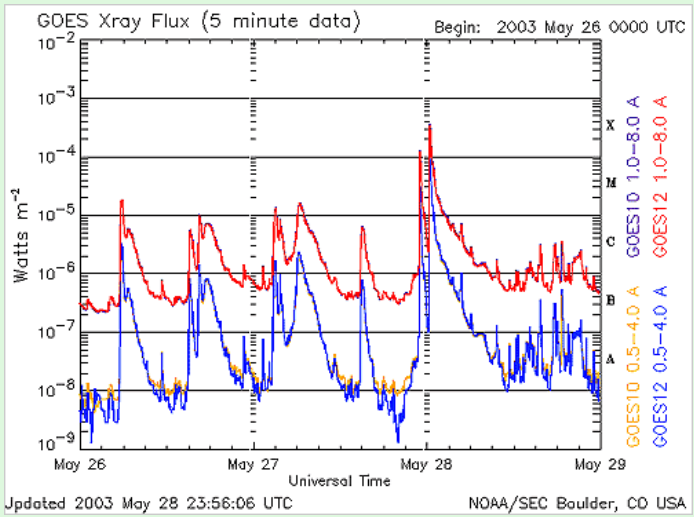
GOES 5-min X-ray Plot

1. Click on "**GOES 5 Minute X-ray Plot**" (live data). Observe the red line on the graph. This line indicates the level of solar activity that will affect Earth.
2. Using the solar x-ray activity scale (A,B,C,M, and X) along the right side of the graph, determine the power of the solar storm.
   - Levels A and B indicate that *Aurora* sightings are only possible in higher latitudes.
   - Level C indicates that *Aurora* sightings are possible further south.
   - Levels M and X indicate that *Aurora* sightings are possible as far south as Texas!
3. Refer to your 'Storm Signals Data Collection' sheet to answer questions **(e)**, **(f),** and the (**Comprehension Question**).
4. Close the current window and return to http://son.nasa.gov/tass/tools.htm .

GOES 5-min X-ray Plot

ABOUT THE DATA:

X-rays are continually emitted from the Sun. However, detecting significant increases in the intensity of those x-rays can provide an early warning of a solar storm. Scientists have developed a simple rating system for this solar x-ray activity.



The solar x--ray activity scale along the right side (A,B,C,M, and X), determines the intensity of the solar storm. A is the lowest level, B is 10 times more powerful than A, C is 10 times more powerful than B, M is 10 times more powerful than C, and X is 10 times stronger than M. So this makes an X event 10,000 times stronger than A. In addition, each level can be further divided from 1.0 to 9.9. This means you could have a C2.3 event, or a B7.9 or an M6.5 However, since X is the highest level, the numbers don't stop at X9.9.

In October 28, 2003 there was an X17.2 flare followed several days later by one that was approximately X28. It was actually so strong it was hard to measure. These flares were the biggest ever measured.

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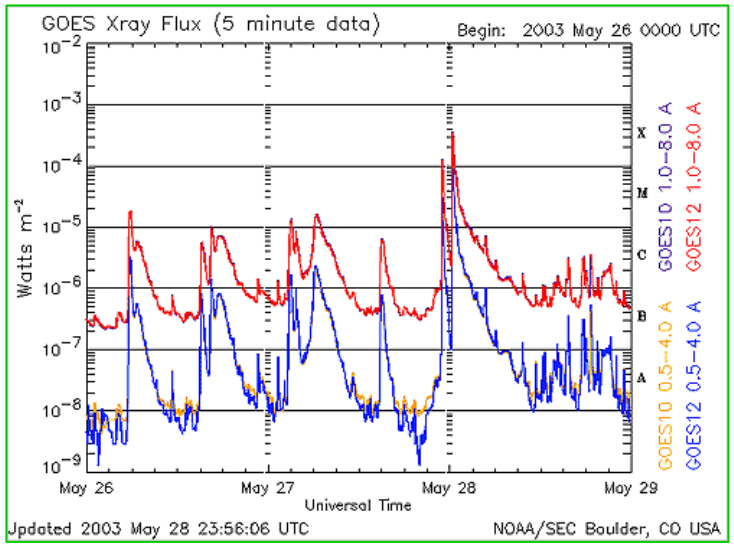
GOES 5-min X-ray Plot



ANALYSIS TIP:
Two GOES satellites record solar x-ray emission, GOES 10 and GOES 12. The red plot from GOES 12 is the one we want to use.

REMEMBER:
This is a 3-day plot. It usually takes 3 days for solar storms to reach Earth.

ABOUT THE DATA:
It is important to find out if these flares were on the side of the Sun facing us. Flares from the side of the Sun facing us are more likely to disturb Earth's magnetosphere than flares that erupt from the edges. You can use images 1-6 on the Sun-Earth Viewer to evaluate the location of the emissions from the Sun.

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